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## Research performance management in a CRIS environment

*Does research evaluation affect publishing activity?*

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# Research performance management in a CRIS environment: Does research evaluation affect publishing activity?

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## Summary

In this article we describe the results from a study of researchers' publishing activity at one Danish university before and after the implementation of a national research evaluation system (RES). More specifically, we investigate the extent to which researchers at Aalborg University publish in prestigious journals in a period of ten years.

Different yardsticks were used to measure the prestige of publications; an internal yardstick and several external yardsticks. The internal yardstick has been developed as part of the Bibliometric Research Indicator, namely the Authority List of Journals. The external yardsticks are the share of publications in Web of Science and Scopus and their measures of prestige, namely the Journal Impact Factor (JIF) and the Source Normalised Impact per Paper (SNIP).

The results regarding the publishing activity as measured by the national Danish RES show that the share of publications without level decreases, the share of publications in 'normal' (level 1) journals increases and the share of publications in 'prestigious' (level 2) journals is status quo. The results regarding the publishing activity measured in relation to external yardsticks show that Aalborg University has had a relative larger increase than Denmark and Norway in the amount of Scopus publications. Aalborg University has also had a larger increase than Denmark in the amount of WOS publications. The results also show that Aalborg University has published in slightly more prestigious journals if measured by JIF and SNIP. However, we do not have evidence supporting the assumption underlying the implementation of the Bibliometric Research Indicator, namely an increase in publications in prestigious journals.

## 1 Introduction

This article presents and discusses results on the publishing activities of researchers at one Danish university before and after the implementation of a national performance based funding system for higher education, or in Whitley's (2007, p. 6) terminology, a research evaluation system (RES). The study only includes publishing activities related to publications in publications channels with ISSN, which we denote ISSN publications. The purpose of our investigation is to gather insight into possible effects of imposing a RES. Knowledge about changes in researchers' publishing activity is hence very interesting as an indication of such effects.

In line with the tendency towards more political accountability and thereby more active steering of research (e.g., Whitley, 2007; Braun, 2003; OECD, 1997), the Danish Government has imple-

mented a RES as a mean to measure research performance at Danish universities (Jakobsen, et al., 2010; Bruun Jensen, 2011). This RES is denoted the Bibliometric Research Indicator and it was first applied for measuring research published in 2008, in order to allocate funds for 2010. With its application on ISSN publications from 2010, we now have 3 years of experience with the indicator.

The Danish Bibliometric Research Indicator is similar to the Norwegian Model (Schneider, 2009; Sivertsen, 2010) as it builds upon comparison of all publishing activities, and it aims at embracing all scientific fields in one overall model. The baseline of the model is the so-called Authority Lists of publication channels. So-far two lists have been constructed, one for Journals and one for Publishers (in the near future two more lists will be introduced, a list of conference series, and a list of book series). As earlier stated the Authority List for Publishers is not considered in the analysis in this article. Only research published in a publication channel which is listed in one of the Authority Lists are counted and weighted. By applying different weights for different types of research publications and publication channels, the Bibliometric Research Indicator, as with the Norwegian model, comprise a model that aims to measuring performance and not merely productivity. The latter has been put forward as a weakness of the Australian approach for research performance measuring (Butler, 2003, 2004). The Authority Lists are dynamic and they are updated once every year by one of the 68 subject area groups, consisting of 4-10 researchers in the specific field, representing all relevant universities. Once a year the subject area groups assort the Journals into two levels ('prestigious' – level 2, and 'normal' – level 1), which is applied for giving weighted scores to each research publication. Level 1 comprises 80 % of the world production within each field while level 2 comprises 20 % of the world production. An article in a level 2 journal is assigned 3 basic points, whereas an article in a level 1 journal is assigned 1 basic point. These weighted scores, are included in the model as it is presumed that they will restrain the differences between research fields and their publishing activity, and hence is considered to be one overarching model for all research fields (Forsknings- og Innovationsstyrelsen, 2009; Sivertsen, 2010). Authority List are published by the Ministry at the end of the year in question. In relation to Whitley's (2007, p. 9) types of research evaluation systems, the Bibliometric Research Indicator, is characterised as a strong RES.

Several expected incentives were mentioned as effects of implementing the model. Two of these are very relevant in relation to the present article. Firstly, it is expected that the implementation of the Bibliometric Research Indicator will encourage to increased scientific production. Secondly, it is expected that it will "...encourage behaviour that creates incentives for publishing in the more prestigious journals" (Forsknings- og Innovationsstyrelsen, 2009 – translated from Danish). Hence the behavioural effects on scientists of implementing research assessment exercises is very interesting since one of the main arguments for implementing such exercises is to change the behaviour of scientists.

The remainder of the article is organised as follows. In the following section we describe background knowledge on implementation of the CRIS system at Aalborg University, which is important for the analysis of our results. Further, we elucidate how the national research evaluation scheme, named the Bibliometric Research Indicator has been implemented at Aalborg University. In section 3 we present the research question scrutinized in the article. Section 4 explicates the methodical approach undertaken to investigate the research question. In section 5 we present the results, and in the last section, section 6, we discuss our results and provide final conclusions.

## 2 The history of VBN, the CRIS at Aalborg University

Aalborg University was created in 1974. Today more than 14,000 students are enrolled at the University, ranging from students at preparatory courses to doctoral-level candidates. The University employs approximately 2,000 faculty and 800 administrative and technical staff and it encompasses four faculties: The Faculty of Humanities, The Faculty of Social Sciences, The Faculty of Engineering and Science, and The Faculty of Medicine.

The idea of developing an online research information system at Aalborg University arose in 1999. Together with The Regional Council of the North Denmark Region a project was formed with the vision of making the research at the university visible and accessible to the regional business community.

Aalborg University partnered up with Atira A/S ([www.atira.dk/](http://www.atira.dk/)) in developing a CRIS system, and in 2002 the first version of an online research information system was in place. This system later evolved into the PURE system. Publications from 1992 were converted into the online system, and the birth of the knowledge database (VBN) of Aalborg University running on the PURE system was a reality.

In 2004 the cooperation with The North Denmark Region ended as planned and the developing of VBN continued as a part of the university administration anchored at the university library. Since 2006 VBN has played a central role as an internal management tool. At this point in time the Rector of the university made it clear that if the research output was not registered in VBN it did not count, e.g., in each researcher's yearly staff development interview with the management. Further, funding allocation to the faculties based on research output has been used at Aalborg University for some time. This development paved the way for an easy acceptance, when the Bibliometric Research Indicator was introduced by the Danish Ministry of Science, Innovation and Higher Education in 2008. Today, the Bibliometric Research Indicator is one of the key indicators of internal allocation of research funds at Aalborg University, and hence researchers at Aalborg University are assumed to be accustomed to the indicator.

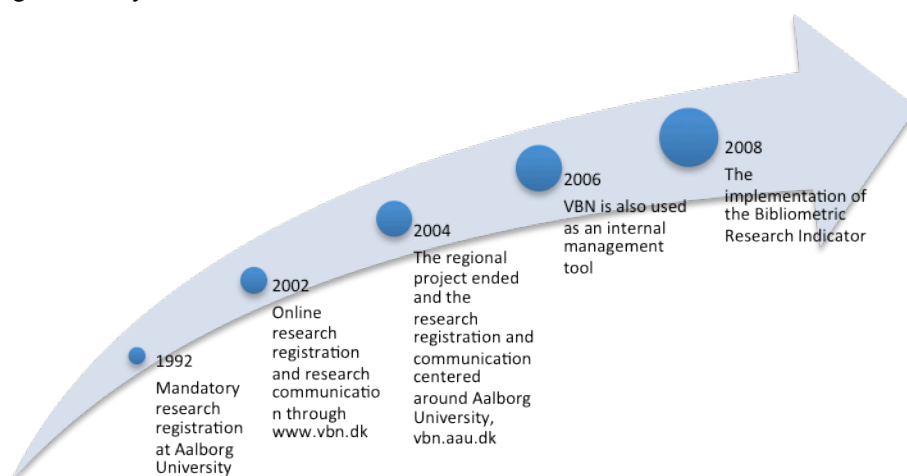


Figure 1: Historical time-line for VBN, Aalborg University's CRIS system

### 3 Research agenda

In line with the stated purpose of implementing the Bibliometric Research Indicator this article examines how researchers' publishing activity has changed during a period where the research performance measuring system has been implemented. Specifically, we investigate:

- The extent to which researchers at Aalborg University publish in prestigious journals, *and*
- How the publishing activity correlates with the implementation of a national RES

It is very difficult to establish cause-and-effect relationships when one is analysing peoples' behaviour. This is naturally also the case in analysing the effects of introducing a RES and researchers' behaviour. For instance, Leifner (2003) shows that the most powerful tool for managers is funding, but at the same time performance-based funding bring about unintended side effects. It is not possible to control all variables that might intertwine in researcher publishing activity. Hence it is very difficult to identify clear-cut cause and effect relationships between implementing a RES and researchers' behaviour. Further, when considering the time span from submitting an article to a journal until that article appears in the journal, and the fact that the Authority Lists are published at the end of the year in question, it is difficult to pinpoint when a change in behaviour caused by the introduction of the Bibliometric Research Indicator will show in actual publishing activity. In this article, we examine, whether or not we can identify a pattern that might indicate a relationship between the implementation of the Bibliometric Research Indicator and changes in researchers' publishing activity.

### 4 Method

The main methodical question to ask when setting forth to analyse the extent to which publications are prestigious, is:

- Which yardstick can be used for measuring the prestige of publications?

This question can be answered in several ways. Each of which will have great consequences on the results, and not least the conclusions that might be drawn based on these results. In the present article, we take two approaches for answering the question. Firstly, we use the yardstick that has been developed as part of the Bibliometric Indicator, namely the Authority List of Journals. This is characterised as an internal yardstick, since it measures prestige on the Bibliometric Research Indicator's own terms. Secondly, we use external yardsticks. These external yardsticks are the share of ISSN publications in internationally recognised databases, such as Web of Science (WOS) and Scopus, and their measures of prestige, namely the Journal Impact Factor (JIF) and the Source Normalised Impact per Paper (SNIP), respectively.

To be more precise, we investigate the research question by examining research output from 2002-2011, which is 6 years prior to and 4 years after the implementation of the Bibliometric Research Indicator. The bibliographic data and categorisation of each registration in the CRIS system is checked by librarians in several iterations. However, at the time of our analysis the ISSN publications from 2011 have not been fully checked. In relation to the internal yardstick, we constructed a Cumulative Authority List of Journals, comprising all journals that appeared either on the Authority List from 2009, 2010 or 2011. Since the list is applied for measuring

prestige in years prior to the development of an Authority List, we find that it is most fair to include all journals that ever appeared on the Authority List (including journals that are later combined, ceased, suspended, etc.). The Cumulative Authority List comprises 19.148 journals, which is 358 more journals than the Authority List from 2011. In order to assign a level to each 19.148 journal, we use the most recently assigned level as the point of departure, as we believe this list to be the most refined Authority List. Hereby, we have a yardstick for measuring journal prestige in the Bibliometric Research Indicator's own terms, as it for each year in question can show the share of ISSN publications in level 2 journals (prestigious), level 1 journals (normal), and journals not on the Cumulative Authority List of Journals.

In relation to the external yardstick we look at the share of publications in Scopus and Web of Science (WOS), respectively. Specifically, we examine the percentages of ISSN publications indexed in the two databases, as this can be considered as one indicator of quality. Both Scopus and WOS have expanded their databases during the years in question. To avoid the fallacy of measuring this growth of the database, we compare our data with 'master' lists covering all journals indexed by Scopus and WOS, respectively. For WOS, we use the so-called 'Master Journal List' (<http://ip-science.thomsonreuters.com/mjl/>), and for Scopus the 'List of Journals' (<http://www.info.sciverse.com/scopus/scopus-in-detail/facts>). The WOS Master Journal List covers all journals that are indexed in 2011, while the Scopus list of journals includes both active and previously indexed journals. The latter mainly concerns publication channels that are ceased or the like.

We compare the ISSN of each publication from Aalborg University, with these two 'master' lists. In this way, we can deduce whether or not the publication channel in question at some point is indexed by either Scopus or WOS. We do not examine whether the specific article in question is to be found in Scopus or WOS, respectively. The benefit of this approach is that we measure all years against the same yardstick, and hence can draw comparisons across the 10-year period.

To provide more specific data on the development in prestige of publications from Aalborg University we use the JIF and the SNIP. JIF is based on average numbers of citations obtained by a journal and is the most widely recognized proxy for journal quality and thus often used as guideline for manuscript submission. SNIP is a contextual journal impact measure, which takes several contextual factors into account in order to provide an impact measure that is applicable in comparison between fields and research practices (Moed, 2010; Moed, et al. 2012). For each of the ten years in question we calculate an average JIF and an average SNIP. The publications from Aalborg University are added the JIF and SNIP from the year in question, where they are available. The average JIF or SNIP for each of the ten years are calculated by summing up the JIF or SNIP of each publication, and dividing this with the number of publications from Aalborg University that have a JIF or SNIP greater than 0. Hereby, we gather knowledge on the average prestige of publications published by researchers from Aalborg University.

## 5 Results and discussion

This section consists of two sub-sections. Firstly, we present and analyse results based on the changes of researcher publishing activities as measured internally. That is, using the Cumulative Authority List of Journals as our yardstick. Secondly, we present and analyse results from comparing Aalborg University publications with external sources and measures.

## 5.1 Publishing activity as measured by the national Danish RES

The number of publications by researchers from Aalborg University has increased in the ten-year timespan in question from 996 in 2002 to 2,116 in 2011. Figure 2 shows researchers' publishing activity in 2002-2011 in percentages in relation to the three categories of journals in the Bibliometric Research Indicator. That is, publications in level 2 journals, in level 1 journals, and in journals that are not included in the Authority List of Journals.

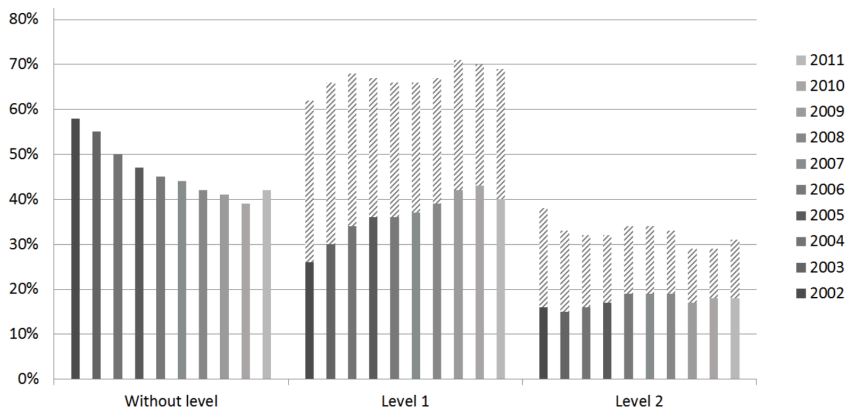


Figure 2: Publishing activity measured by Cumulative Authority List for Journals (percentages). The shaded areas show percentages of publications in publication channels on the Authority List, only

Overall, the Figure 2 shows a decrease in the share of publications in journals without level, an increase in the share of publications in level 1 journals, and status quo in the share of publications in the most prestigious journals (level 2). Again, it is important to bear in mind that publications from 2011 have not yet been fully validated. We expect that this validation work will move publications upwards in the categories, and hence that the share of 2011 publications in journals not on the Authority List will decrease. This tendency towards a decrease in articles in journals not on the Authority List, and an increase in articles in level 1 journals is visible in the whole time span in question. Hence, it is difficult to attribute this development to the implementation of the Bibliometric Research Indicator. However, we do not see an increase in the percentages of publications in level 2 journals. This development is interesting in relation to the reaction of Australian researchers to performance based on raw publication counts, as illustrated by Butler (2003, 2004). That is, in the mid-1990s Australia introduced a funding system based on research performance (raw publication counts). The reaction from the researchers was to publish more, but in journals of lower prestige as measured by applying the Journal Impact Factor. In our case, we do not see a decrease in the percentages of prestigious journal publications. This can be taken as an indication that the Bibliometric Research Indicator does not hold the same unintended incentive as the 'Australian Model'. Further, this is supported by Sivertsen (2010) in his analysis of the Norwegian model, though his analysis focuses on publications in journals covered by the model, only. Furthermore, it is somewhat comparable to results obtained in a Spanish context (Jiménez-Contreras, Anegón, López-Cózar, 2003). That is, Jiménez-Contreras and colleagues show an increase in scientific production parallel to the introduction of a nation research incentive system.

Throughout the whole period Aalborg University has just below 20% of ISSN publications in level 2 journals, which is in line with the incentives of the Bibliometric Research Indicator since level 2 journals are to encompass 20% of the most prestigious publications. However, the model is intended to encompass all scientific publications (with the 20% most prestigious in level 2), and hence the percentages should be calculated within publication included in the model, only. That is, publications without level should be excluded from the calculation of these percentages, which is in line with the calculation in Sivertsen's (2010) analysis of the Norwegian Model. These percentages (the shaded areas in Figure 1) show that the share of publications from Aalborg University in prestigious level 2 is approximately 50% above the expected level. However, though impressive as such, the share of level 2 publications has not increased significantly in the period in question.

## 5.2 Publishing activity measured in relation to external yardsticks

Figure 3 shows how the actual number of publications from Aalborg University in WOS and Scopus has developed in comparison to the development in Denmark and Norway. Norway is an interesting frame of reference due to the implementation of the Norwegian Model in 2005 (measuring publications published in 2004). In order to make comparisons between the production of one university and two countries, the amount in 2002 is set as index 1.00. The general increase for all three entities in WOS and Scopus, respectively, is not relevant as such, since it most likely just illustrate the increase of coverage in the two databases. What Figure 3 does show is relative comparable developments between the three entities in the two databases. In Figure 3 we see that Aalborg University has had a relative larger increase than Denmark and Norway in the amount of Scopus publications. In relation to WOS publication, Aalborg University, along with Norway, has similarly increased more than Denmark. This shows that the scientific productivity at Aalborg University is increasing more than it is for the country as such.

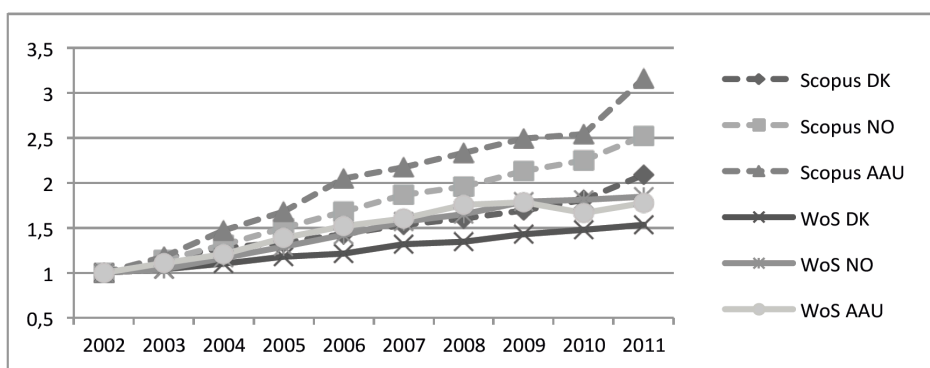


Figure 3: Development in actual WOS and Scopus publication for Denmark (DK), Norway (NO), and AAU. 2002 is set as index figure 1.00 for all cases, respectively, as this allows for comparison

The amount of ISSN publications from Aalborg University has doubled from 1,381 in 2002 to 2,116 in 2011. In Figure 4 we see that the percentage of publications from Aalborg University have increased when compared to both Scopus and WOS master lists of journals. The fact that the share is higher in Scopus than in WOS is logical in relation to the larger coverage of the Sco-



pus database. However, from 2006 and forth the share of WOS is stable at around 35%, while it increases a bit for Scopus. Again it is important to bear in mind that 2011 figures are to be taken with a pinch of salt.

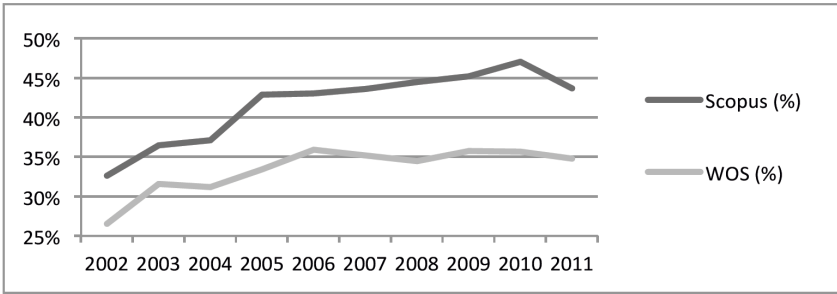


Figure 4: The share of publications from Aalborg University found in master lists of journals for Scopus and WOS, respectively

Average SNIP and average JIF are not directly comparable, since SNIP is a normalised score while JIF is not, as mentioned in section 4. However, we depict them together in Figure 5 to illustrate that they generally show the same trend. Namely, that at Aalborg University in 2002-2011 has published in slightly more prestigious journals if measured with either of these citation based measures.

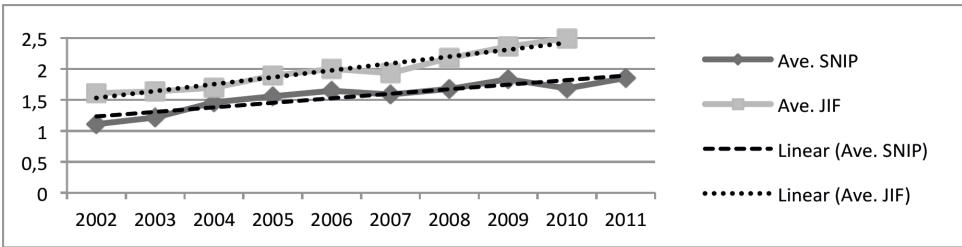


Figure 5: Average SNIP and Average JIF of publications from Aalborg University (2011 JIF not available at time of analysis)

Focusing on the JIF there seems to be an increase which is congruent to the implementation of the Bibliometric Research Indicator with a JIF of 1.93 in 2007 and 2.49 in 2010. One way to read this is that the Bibliometric Research Indicator might have instigated this change in publishing behaviour. This said the development in the share of level 2 publications have not risen in same time span, which does not support the conclusion that the Bibliometric Research Indicator have instigate the registered change in researchers' publishing activity. Again the time lap between submitting an article and having it published is important to bear in mind when analysing the effect of the Bibliometric Research Indicator.

## 6 Conclusion and future work

In the present article we have aimed at investigating the effect of implementation of a research evaluation system on researchers' publishing activities. One question that remains is whether a time-span of 4-years after the implementation of the indicator is enough in order to derive a clear picture regarding changes in publishing activity. The time from submitting an article to a journal until publication of that article might be very long, and hence one might argue that a much longer time-span is needed in order to retrieve convincing results.

Nonetheless, the results put forward in the present article does show that we do not have evidence supporting one of the motivations for implementation of the Bibliometric Research Indicator, namely an incentive to increase the share of publications in prestigious journals.

The second motivation for implementing the national RES, described in the introduction, stated that the RES will be an incentive to increase scientific production. In relation to this motivation our results show a trend towards more publications covered by the Authority Lists of Journals throughout the ten-year time-span investigated. The trend set off before the implementation of the RES, and our results does not indicate a shift in this tendency that correlates with implementation of the RES.

In relation to the research agenda put forward in section 3, we have shown the extent to which researchers at Aalborg University publish in prestigious journals, *as well as how* the publishing activity correlates with the implementation of a national RES.

The analyses presented in the present article are just scratches on the surface and future work is to be done in order to fully understand the effect of implementing a national RES. Specifically, it is interesting to know how the publishing activities of researchers change in the years to come, and we will conduct similar analysis as soon as data is ready. Further, it will be interesting to include analysis on the Authority List of Publishers as soon as this list is implemented in its full configuration in 2012 (including levels for Publishers in the same way as Journals). Furthermore, we will dig into the data to gather knowledge on the publishing activities of researchers between faculties and departments.

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